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21-23 June 2005, at US Military Academy, West Point, NY

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Original title on 712 A/B: LHA(R) Cargo Handling System Trade Study Models

Revised title: N/A

Presented in (input and Bold one): (**WG 13**, CG___, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:
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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 JUN 2005	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
LHA(R) Cargo Handling System Trade Study Models	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **NSWC PC 110 Vernon Ave. Panama City, FL 32407**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005 . , The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**17**	

LHA(R) Cargo Handling System Trade Study Models

- presented to the 73nd Military Operations Research Society Symposium -

Tyson Kackley

Naval Surface Warfare Center Panama City

Littoral Warfare Analysis

June 2005

Agenda

- Motivation for Tasking
- Tasking
- Approach and Assumptions
- Model Functionality
- Demonstration
- Conclusions
- Future Directions

Caveat

This brief is for one of the ship concepts for LHA(R) and does not reflect the final LHA(R) design.

Motivation for Tasking

- LHA(R) undergoing trade study to answer question:
  - What cargo handling system is best for the LHA(R) well deck?
- Current LHDs use a combination of fork trucks and overhead cargo monorail to move pallets.

Why Change?

- Cargo monorail maintenance.
- If the well deck had a bridge crane (like LPD-17), a variety of additional tasks could be performed over and above pallet loading.
  - LCAC Skirt Maintenance
  - LCAC Engine Maintenance
  - etc.

Why Not Change?

- Requirement handed down from earlier LHA/LHDs:
  - 150 pallets/hour must pass through the well deck and out onto LCACs.

- Questions:
  - Will a bridge crane meet this requirement?
  - Does the current system meet this requirement?

Tasking

- Construct AutoMod simulations to determine the pallet throughput achievable using:
  - Fork Trucks alone.
  - Current cargo monorail system.
  - Proposed bridge crane system.

Approach & Assumptions

- For current operations, consulted with SMEs
  - Former Combat Cargo Officer
  - Former LCAC operator.
- For proposed bridge crane operations, consulted with LHA(R) Mission Systems IPT.
  - Research into currently available bridge crane systems.
  - Notional characteristics of bridge crane system.
- Utilized previously collected data relating to well deck operations.

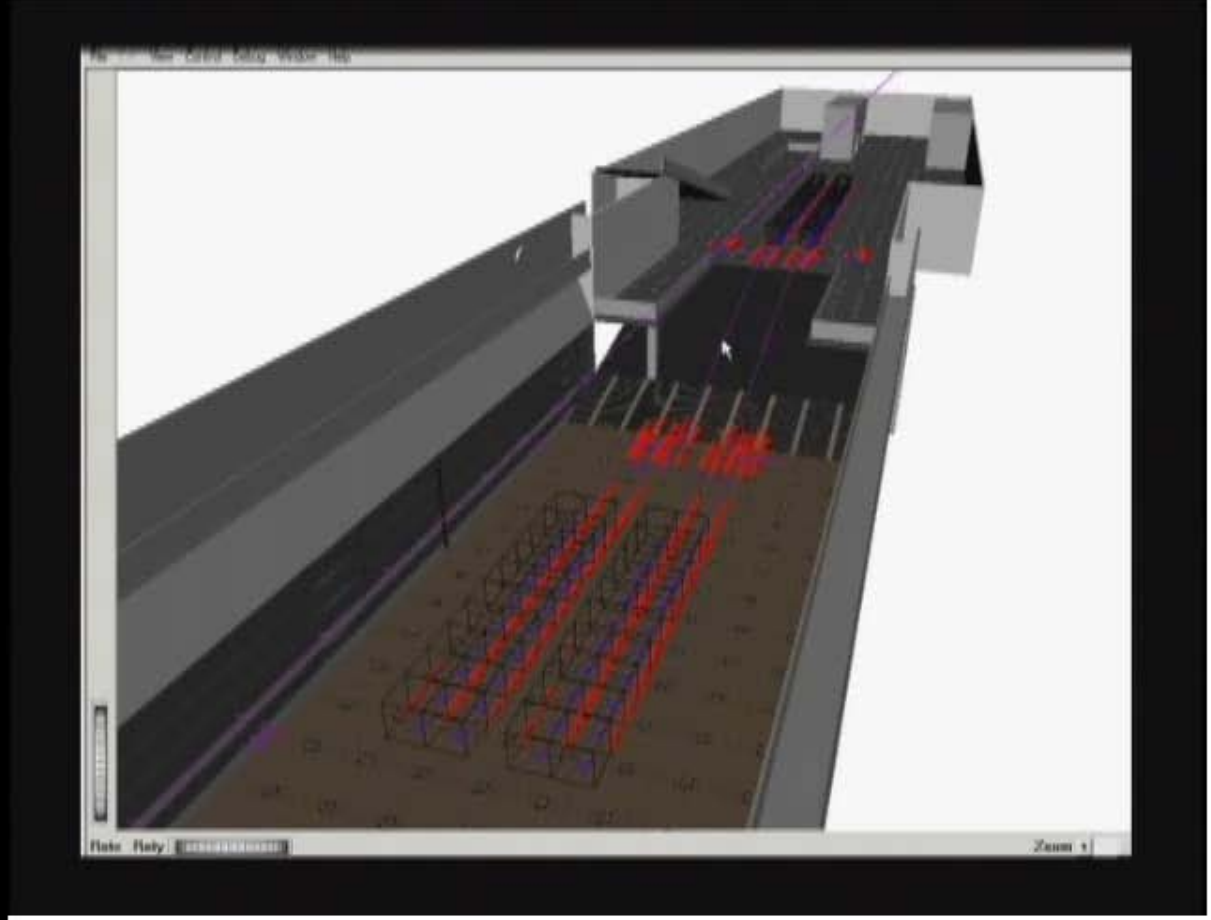
Approach & Assumptions

- Resulting assumptions:
  - 40 pallets pre-staged on the upper vehicle deck
  - 1 LCAC off-cushion in well deck close to ramp.
  - 10K rough terrain fork trucks always back down the ramp.
  - Fork truck speed varies based on level/inclined surface.
  - Only one fork truck at a time allowed onto LCAC.

Model Functionality

- For each cargo handling option, the model
  - Loads the LCAC as fast as possible.
  - Allows the LCAC to leave.
  - Brings the next LCAC in.

- Extra time added for non-concurrent operations:
  - Time required for
    - Starting/stopping engines
    - Raising/lowering bow ramp
    - Fueling
    - etc.



Quad-AutoMod-2min.wmv

Conclusions

- 1. Neither fork trucks alone nor current monorail system could meet the 150 pallets/hr requirement.
  - Why?
    - Most likely because early LHDs had 9 cargo monorail cars.
    - Latest LHDs only have 3 monorail cars, with one of them held in reserve.
- 2. The bridge crane achieved throughput comparable to the current monorail system.

Future Directions

- Develop similar model to determine realistic, achievable throughput rates of notional skin-to-skin replenishment.
  - On Container Ship
    - Setup
    - Pickup
  - Transfer
  - On Receiving Ship – MPF(F)
    - Set down
    - Break out
    - Transport below deck.

Future Directions

- Develop similar model to determine realistic, achievable throughput rates of notional interfaces between connectors and MPF(F), taking into account
  - Geometry of interface
  - Material Handling Equipment used
  - Manpower required
  - Vehicles versus palletized or containerized cargo
- Use models to identify bottlenecks and compare interface options.

Future Directions

- But how do we deal with uncertainty regarding MPF(F) and Connector designs?

- A) Make baseline assumptions
  - Deck space available.
  - Cargo handling equipment available.
  - Types of cargo being transferred.
  - Provides a baseline throughput rate.

or

- B) Model *several* promising design scenarios and use the models to evaluate throughput of each option.

Questions?